A1$

CERTIFICATE OF MAILING BY "EXPRESS MAIL"
"Express Mail" Mailing Label No. EM033395178US
Date of Deposit: September 5, 1997
I hereby certify that this paper or fee is being deposited with sufficient postage with the United States Postal Services "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Box Patent Application, Assistant Commissioner for Patents , Washington, D.C. 20231
Drew R. Herndon
(Typed or Printed Name of Person Mailing Paper or Fee)
Drew R Herndon
(Signature of Person Mailing Paper or Fee)

PATENT
Attorney Docket No. 17509-713

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of)
)
Hill Branscomb)
) Prior Application
Application No.: Not yet assigned)
(Rule 60 Continuation of 08/243,046)) Group Art Unit: 2415
Filed: Herewith (September 5, 1997))
) Examiner: M. Luu
For: **APPARATUS AND METHOD FOR**)
ASSEMBLING CONTENT)
ADDRESSABLE VIDEO)

UTILITY PATENT
TRANSMITTAL OF FILING UNDER 37 CFR 1.60

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

This is a request for filing a [X] Continuation [ ] Divisional application under 37 CFR 1.60, of pending prior Application No. 08/243,046 filed on May 16, 1994 by Hill Branscomb for **APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO**.

1. Application

Enclosed are:

[X] a true copy of the complete prior application as filed including drawings;
34 pages of specification, claims and abstract, and
6 sheet(s) of [ ] formal [X] informal drawing(s);
[X] a copy of the Declaration as filed in the prior application;
[X] copies of the Assignment(s) as filed in the prior application;

[X] 1 verified statement claiming small entity status as filed with the prior application;
[X] other: Supplemental Declaration of inventor as filed in parent application;
Preliminary Amendment filed January 6, 1993 and cited in Supplemental Declaration by inventor.
Declaration under 37 CFR 1.132 of Michael T. MacKay

2. Amendment

[X] Amend the specification by inserting before the first line the sentence: --This application is a [X] continuation, [ ] divisional, of copending Application No. 08/243,046, filed May 16, 1994, now allowed, which is a continuation of Application No. 08/146,400, filed November 1, 1993, now abandoned, which is a continuation in part of Application No. 08/000,927, filed January 6, 1993, now abandoned, which is a continuation in part of Application No. 07/640,489, filed December 8, 1989, now abandoned.--

[ ] Cancel in this application original claims _____ of the prior application before calculating the filing fee.

[X] A preliminary amendment is enclosed. The enclosed Preliminary Amendment was originally filed January 6, 1993 in parent application Serial No. 08/000,927, and is referred to in the Supplemental Declaration by the inventor attached hereto. Entry of this Preliminary Amendment is requested.

[ ] Delete the following inventor(s) name(s) from this application: _____.

3. Power of Attorney

[X] The power of attorney in the prior application is to: Mark A. Haynes

Paul Davis	29,294
Mark A. Haynes	30,846
Charles C. Cary	36,764
Michael J. Murphy	37,404
Michael J. Panepucci	37,203
David J. Weitz	38,362
Kent R. Richardson	39,443
George A. Willman	P-41,378
Nancy Gamburd	38,147
John J. Bruckner	35,816
U.P. Peter Eng	39,666

[X] The power appears in the original papers in the prior application.

[ ] Since the power does not appear in the original papers, a copy of the power in the prior application is enclosed.

[ ] A new power has been executed and is attached.

[ ] Recognize as Associate Attorney(s): _____

4. Fee Calculation The fee has been calculated as follows:

CLAIMS					
	NO. OF CLAIMS		EXTRA CLAIMS	RATE	FEE
Basic Application Fee					$770.00
Total Claims	13	MINUS 20 =	0	$22.00=	0.00
Independent Claims	4	MINUS 3 =	1	$80.00=	80.00
If multiple dependent claims are presented, add $260.00					-0-
Total Application Fee					$850.00
If verified statement claiming small entity status is enclosed, subtract 50% of Total Application Fee					-425.00
Add Recording Fee of $40.00 if Assignment document is enclosed					40.00
TOTAL APPLICATION FEE DUE					$465.00

[ ] A check in the amount of $___ is enclosed.

[X] Charge $ 465.00 to Deposit Account No. 23-2415 (Docket No. 17509-713). The Assistant Commissioner is authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account 23-2415. A duplicate copy of this paper is enclosed.

[ ] Fees will be paid when responding to the Notice to File Missing Parts.

Address all future communications to:

Mark A. Haynes
Wilson, Sonsini, Goodrich & Rosati
650 Page Mill Road
Palo Alto, CA 94304-1050

Respectfully submitted,

WILSON SONSINI GOODRICH & ROSATI

Date: September 5, 1997

By: _____
Mark A. Haynes
Registration No. 30,846

650 Page Mill Road
Palo Alto, CA 94304-1050
(415) 493-9300

Attorney Docket #: ADIN7914:CON-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	PATENT
HILL BRANSCOMB	)	
Application No.: 08/000,927	)	
Filed: January 6, 1993	)	Group Art Unit: 2609
For: APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO	)	Examiner: M. Luu

DECLARATION OF MICHAEL T. MacKAY UNDER 37 C.F.R. § 1.132

I, Michael T. MacKay, hereby declare as follows:

1. An expert with over 15 years of experience in the design, implementation and operation of multi-media environments, including computer graphics and video. A copy of a recent resume for me is attached hereto as Exhibit 1.

2. Over the course of my career, I have been involved in the hiring and management of teams of engineers, and have developed a knowledge of the ordinary level of skill in the video and computer graphics arts. Although, the ordinary level of skill may be somewhat higher, the minimum skills required are a degree in electrical engineering or computer science with at least one year of experience in film, video, and graphics engineering.

3. In connection with the above-identified U.S. patent application, I have been informed that the Patent Examiner has rejected certain claims in the application, on the basis that the application fails to provide an adequate written description of the invention. I have reviewed the application and claims. It is my opinion that all elements of the claims as described in the application, and that the description is sufficient to enable a person of ordinary skill in the computer graphics art to practice the invention.

4. Particularly, the Examiner has stated:

> The Applicant has failed to disclose the exact "means for associating tags with frames of video data..." as recited in claims 1 and 7. How is the "associating means" coupled to the storage means since the drawings do not show the "associating tag means" as specified in the claims. (Page 3 of the Official Action mailed April 30, 1993).

5. The elements in claims 1 and 7 to which this rejection is directed, read as follows:

In Claim 1:

> "means, coupled with the storage means, for associating tags with frames of video data in the plurality, the tags indicating the contents of the video images defined by the associated frames;"

In Claim 7:

> "associating tags with frames of video data in the plurality, the tags indicating the contents of the video images defined by the associated frames;"

6. In the specification, the "means for associating tags", and the step of associating tags with frames of video data is clearly described. In particular, in Fig. 4, step 401 reads "ASSIGN KEY TO EACH VIDEO FRAME". A person of ordinary skill in the art would readily understand that this results in association of a tag (key) with each video frame. Although the term "key" is used in the figure, those of skill in the art will understand that a key assigned with a frame would be considered a "tag".

7. The process for generating the keys is described on page 11, lines 9-15.

8. Further, on page 15, lines 13-15 of the specification, the step of "stamp keys on frames (or other recording methods)..." describes the associating of tags with frames of video data.

9. In terms of the manner of implementing the tags with the video frames, the specification clearly describes how to make and use the system of tagging frames. Beginning at page 18, line 20, continuing to page 19, line 8, the application describes the use of an expanded SEMPTE time code structure to provide information which indicates the content of the frame.

10. Accordingly, the application describes a system in which tags are associated with frames of video, wherein the tags indicate the content of the frame to which they are associated. Further, the specification enables a person of ordinary skill in the art to create and use such tags.

11. Furthermore, the specification clearly shows how the

means for associating tags is coupled to the storage means. In particular, the machine generating the video frames stamps the frames of video with a tag. The associating means is a routine executed by the computer. Fig. 1 of the specification shows the computer 100 connected to the video storage 103 and to the camera position control 101. Thus, it is absolutely clear that the computer 100 which associates the tags with the frames of video data is coupled with the video storage system, and persons of ordinary skill in would unquestionably understand that connection based on a review in the specification.

12. The Examiner has also stated:

> "What exactly is the "associating position means", and how is this "associating position means" coupled to the "processing means" since the drawings do not show the "associating position means" as specified in the claims." (Page 3 of the Official Action mailed April 30, 1993)

13. This rejection is addressed at the following elements of claims 1 and 7:

In Claim 1:

> "means, coupled to the processing means, for associating positions in the content video image with addresses of storage locations storing corresponding frames of video data."

In Claim 7:

> "associating with data processing means the positions in the content video image with addresses of storage locations storing corresponding frames of video data."

14. The specification describes these elements with reference to Fig. 4, elements 402 and 403. This figure describes a computer algorithm by which a content image is generated using the keys that have been assigned to each video frame, and by which the video frames are then compiled for addressing in response to the keys. These two steps are standard computer processes which persons of ordinary skill in the art will clearly understand as a means for associating the position of a video frame in a content image with the content of the video frame based on the key. Thus, the application describes the means for associating positions, and enables a persons of ordinary skill to make and use such means.

15. The application also provides a clear example of an algorithm for creating the means for associating positions at page 15, lines 22 through page 16, line 8. Particularly, the algorithm is based on the use of a data base having a position in the content

image of a key, and associating a key to a video frame by addresses. Thus, the position in the content image is associated with a key, and the key is associated with a frame of data.

16. In am informed that the Examiner is taking the position that the "associating position means" is not shown in the drawings. Fig. 4 illustrates a computer program for accomplishing such tasks, and is therefore believed to show the claimed feature. Furthermore, it's clear that the computer program is executed by the computer which includes a processing means. Thus, the processing means in the computer is associated with or coupled with the means for associating positions, as all computer programs are coupled with their host processor.

17. I have been informed that the Examiner has also stated:

> "What exactly is the "means for accessing the frames of video data", and how is this "means for accessing the frames of video data" coupled with the "position selecting means" and the means for associating positions" since the drawings do not show the "means for accessing the frames of video data". (Page 3 of the Official Action mailed April 30, 1993).

18. The means for accessing the frames of video data appear in claims 2 and 6 in a means plus function format, and in claim 8 in a process format. Review of the specification reveals that the means for selecting a position in the content video image is the input device 111 shown in Fig. 1. Page 7, line 14-line 18, describes the use of the user input device 111, "such as a mouse or track ball" to position a cursor icon 112 on the content image 106. Thus, the user selects a position on the content image using an input device as clearly described in the specification in the drawings.

19. The "means for accessing the frames of video data" in Fig. 1 comprises a computer system 100. This system is expanded in Fig. 2, in which the computer 201 is used to control video disk players 202 and 203. The video disk players access stored frames of video in response to the computer control as well known in the art.

20. Thus, it is submitted that the application describes the means for accessing frames of video, and the means for selecting a position on the content image. Further, the application enables those of ordinary skill in the art to practice the invention claimed.

21. In summary, the invention described and claimed in the above identified U.S. patent application uses programming techniques

well known in the art to accomplish the unique features described. It is based on using an associative link between a content image, and a key or tag indicating the content of a video frame associated with the tag. The processing control can be easily implemented using data base or table look-up techniques well known in the computer graphics art.

22. Overall, it is my opinion that all the elements claimed in the present application are described in the specification, and the description of such elements enables a person of ordinary skill in the art to practice the invention.

I hereby declare that all statements made herein of my knowledge are true and that all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the above reference application or any patent issuing thereon.

22 OCT 93
Date

Michael T. MacKay

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application	)	*PATENT APPLICATION*
Inventor(s): *Hill Branscomb*	)	
Serial No.: *07/640,489*	)	
Filed: *01/11/91*	)	
Title: *APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO*	)	

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
37 C.F.R §1.9(f) AND 1.27(c) - SMALL BUSINESS CONCERN

I hereby declare that I am:

___ *The owner of the small business concern identified below.*

_X_ *An official of the small business concern empowered to act on behalf of the concern identified below.*

Name: *Advanced Interaction, Inc.*

Address: *2810 Fillmore Street, San Francisco, California 94123*

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 C.F.R. §121.3-18, and reproduced in 37 C.F.R. §1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35 U.S.C. in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third-party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified below with regard to the invention entitled:

APPARATUS AND METHOD FOR ASSEMBLING
CONTENT ADDRESSABLE VIDEO

by inventor(s): *Hill Branscomb*

described in:

_X_ *Application Serial No.* *07/640,489* *filed* *01/11/91*

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the

invention is listed below and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 C.F.R. §1.9(d) or by any concern which would not qualify as a small business concern under 37 C.F.R. §1.9(d) or a nonprofit organization under 37 C.F.R. §1.9(e).*

NAME: _____

ADDRESS: _____

[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

NAME: _____

ADDRESS: _____

[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small business entity is no longer appropriate. (37 C.F.R. §1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Name of Person Signing Hill Branscomb

Title of Person Signing President

Address of Person Signing 2810 Fillmore Street, San Francisco, CA 9412

Signature _____

Date March 5, 1991

---

* *Note: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 C.F.R. §1.27).*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application Inventor: Hill Branscomb SC/Serial No.: 07/640,489 Filed: January 11, 1991 Title: APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO	PATENT APPLICATION Art Unit: 2609 Examiner: M. Luu

CERTIFICATE OF MAILING BY "EXPRESS MAIL" UNDER 37 C.F.R. § 1.10

"Express Mail" mailing label number: RB712972183US
Date of Mailing: January 6, 1993

I hereby certify that this correspondence is being deposited with the United States Postal Service, utilizing the "Express Mail Post Office to Addressee" service addressed to **Commissioner of Patents and Trademarks, Washington, D.C. 20231** and mailed on the above Date of Mailing with the above "Express Mail" mailing label number.

_____(Attorney Signature)
Mark A. Haynes, Reg. No. 30,846
Signature Date: January 6, 1993

PRELIMINARY AMENDMENT

Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

Entry of the following Preliminary Amendment is requested in the File Wrapper Continuation filed herewith.

AMENDMENTS

In the Specification

On page 25, line 11, after "step one", please insert the following:

-- The first step involves storing video frames as in block 400 of Fig. 4.

The store of video frames will be stored in a database as set out in Table I,

entitled Database Frame Location below. As can be seen in the Table I,frames are stored in sequences which consist of an expression which proceeds from note Cm to note Cm#7, corresponding to a transition from event E1 to event E2. This consists of frames 1-420. Each of the 10 expressions in the database are stored.

In the next step, a key is assigned to each video frame corresponding to block 401 of Fig. 4. This is done by searching the database frame location database for the events E1 through E11. According to this step, a table such as Table III, entitled Record Database, set out below is computed. Thus, the first entry in the Table I corresponds to the first entry in Table III. The first event E1 is in original frames 0-60. The transition from E1 to E2 is in original frames 60-360, and the second event stored in frames 360-420. This sequence is divided so that new frame numbers 0-220 are stored with a key identifying them as transition E1 to E2.

In the next step, a content image as shown in Fig. 6 is generated based on the keys. This content image is generated by signing each key a position on the content image as shown on Table II below. Thus, event E1 will be assigned X,Y position (0,160) on the XY scale. Table II also shows the number of frames between each event on the display.

The final step, the video frames are compiled for addressing in response to the key corresponding to block 403 of Fig. 4. This step of compiling video frames results in an assembled database as shown below in Table IV. A given frame, e.g. frame 0 is compiled so it can be accessed in response to position (0,160) on the frame. In this embodiment, a sequence of frames is displayed in response to a user selecting the position which range from frame 0-220 as shown in Table II. In a more simple case as described above, only a single frame may be displayed in response to positioning of the cursor.

Once the content image of Fig. 6 is displayed and the assembled database of Table IV is computed, a user input devise may be used for accessing specific frames in response to a position on the content image as described with reference to block 404 of Fig. 4.

These processing steps are thus executed by the processor 201 of Fig. 2 and interconnected by the databases and tables computed by the processing steps. --

On page 25, line 14, before "Database Frame Location" please insert -- Table I. --

On page 26, please delete line 2 and insert therefore:

-- The special coordinates of the content image are defined below in Table II. Table II. --

On page 26, line 19, before "Record" insert -- Table III. --

On page 26, line 35, before "Assembled" insert -- Table IV. --

On page 26, after the last line, please insert the following:

-- In Table IV, the first column corresponds to a given node, e.g. node E1 in the database. The second column identifies the number of nodes that are associated with the node in column 1. The third column identifies one of the adjacent nodes. The fourth column identifies the number of the frame associated with the first adjacent node identified in column 3. The fifth column identifies a second adjacent node, if any. The sixth column identifies the frame number associated with the second adjacent node. The seventh column identifies the X, Y coordinates on the content image of the node of column 1.

The eighth column identifies the audio which is to be produced in association with the node in column 1. --

REMARKS

In this Preliminary Amendment, the specification is amended to more clearly specify the use of the tables described on pages 25 and 26 of the specification in the context of Fig. 4 of the present invention.

The Examiner had issued a final action in the parent case on October 6, 1992. In such Official action, the Examiner objected to the drawings; rejected the specification under 35 U.S.C. § 112, first paragraph; rejected claims 1-4, 6 and 7-10 under 35 U.S.C. § 112, first paragraph; rejected claims 1, 2, 7, 8 and 9 under 35 U.S.C. § 102(b); rejected claims 3, 6, 10 and 13 under 35 U.S.C. § 102(e); and rejected claims 4 and 11 under 35 U.S.C. § 103.

Each of the Examiner's objections and rejections from the parent application is addressed below.

Objection to the Drawings and Specification

The Examiner objected to the drawings and specification as not showing claimed features of the present invention.

As mentioned above, Applicant has amended the specification to more clearly specify the use of the data by the processing modules to apply the example system discussed on pages 25 and 26 of the specification. It is believed that this will more clearly specify how the modules, which are claimed in the present invention, are interconnected. This amendment also will enable the Examiner to recognize the components of the invention which are shown in the Figures and how they are interconnected.

No new matter has been added, as the added text merely clarifies existing disclosure.

Thus, reconsideration of the objection to the drawings and the specification under 35 U.S.C. § 112, first paragraph, is requested.

Rejection of All Claims Under 35 U.S.C. § 112, first paragraph

The Examiner rejected all claims under 35 U.S.C. § 112, first paragraph, as not enabled. It is submitted that the amendment to the specification set out above should address the Examiner's concern. Accordingly, reconsideration of the rejection of all claims under 35 U.S.C. § 112, first paragraph, is respectfully requested.

Rejection of Claims 1, 2, 7, 8 and 9 Under 35 U.S.C. § 102(b)

The Examiner rejected claims 1, 2, 7, 8 and 9 under 35 U.S.C. § 102(b), as anticipated by Naimark, et.al. Understanding of the invention, the Examiner should reconsider the rejections. Naimark, et al. does not provide means for automatically assembling the database for the content image. Rather, in that system the content image was assembled manually and the frames associated with that content image by manual tabulation. It is that problem that the present invention solves.

Accordingly, reconsideration of the rejection of claims 1, 2, 7, 8 and 9 under 35 U.S.C. § 102(b) is respectfully requested.

Rejection of Claims 3, 6, 10 and 13 Under 35 U.S.C. § 102(e)

The Examiner rejected claims 3, 6, 10 and 13 Under 35 U.S.C. § 102(e) as anticipated by Morgan. It is believed that upon better understanding of the claims in view of the amendments set out above, the Examiner should withdraw this rejection. The Morgan reference cited by the Examiner has no connection with finding video after it has already been stored in a database. Rather it is only concerned with positioning a camera and controlling a camera position to shoot a particular image. Thus, reconsideration of the rejection based on Morgan is requested.

Rejection of Claims 4 and 11 Under 35 U.S.C. § 103

The Examiner rejected claims 4 and 11 Under 35 U.S.C. § 103 as obvious in light of Morgan and the Toshiba robotics paper. It is submitted that these claims clearly distinguish

over the combination of references for the same reason as there base claims distinguish over Morgan. Accordingly, reconsideration is requested.

CONCLUSION

It is submitted that the present application is now in form for allowance. No new matter has been added to the present application, as Applicant has merely clarified the description already present.

The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 06-1325 for any matter in connection with this response, including any fee for extension of time, which may be required.

Respectfully submitted,

Date: Jan. 6, 1993

By: _____
Mark A. Haynes
Reg. No. 30,846

FLIESLER, DUBB, MEYER & LOVEJOY
Four Embarcadero Center, Suite 400
San Francisco, California 94111-4156
Telephone: (415) 362-3800

APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is related to U.S. Patent No. 4,857,902, entitled POSITION-DEPENDENT INTERACTIVITY SYSTEM FOR IMAGE DISPLAY, invented by Naimark, et al., issued August 15, 1989; and to U.S. patent application Serial No. 07/356,543, entitled CONTENT ADDRESSABLE VIDEO SYSTEM FOR IMAGE DISPLAY, filed 89/05/24.

FIELD OF THE INVENTION

The present invention relates to systems for generating and storing video frames of information, such as produced using video/film cameras. In particular, the present invention provides a method and an apparatus for assembling frames of video data so that it may be accessed in response to the content of the respective frames.

BACKGROUND OF THE INVENTION

Interactive video systems, such as described in the above cross referenced U.S. Patent No. 4,857,902, in which a first monitor displays a virtual space which indicates the content of a library of video frames, and a second monitor displays video frames, in response to the position of a cursor on the virtual space, provide a powerful system for accessing video frames based

on the content of the video frames. The content is indicated by the virtual space. To access video based on content, a user moves a cursor to a position on the virtual space. In response to the position of the cursor on the virtual space, a video frame is accessed which has a content indicated by the position of the cursor.

A problem has arisen in compiling video frames for the purposes of addressing them by content for use in such systems. In particular, the video frames are generated in such systems based on a plan organized by a human producer. The film is then shot, such as by flying a helicopter on a geographic grid while filming a center point of reference. For instance, in the one system, a helicopter flew over the Golden Gate Bridge in San Francisco, while focusing the camera on the center of the bridge.

Once the film has been generated, it must be manually compiled into sequences of video frames which correspond to the grid flown over the city. The grid is then drawn in a bit map graphic form for display as the virtual space. A correlation of the virtual space to the video frames is done manually in a time-consuming, tedious process.

It is desirable to provide a method for compiling or generating content addressable video automatically.

SUMMARY OF THE INVENTION

The present invention provides an apparatus and method for assembling content addressable video which is based on storing a plurality of frames of video data at addressable storage locations. Each frame of video data is stored with a tag which indicates the contents of the video image defined by the associated frame. A processing unit, assembles a content video image in response to the tags, including positions in the content image for corresponding frames of video data. Finally, a means, such as a look-up table, is provided for associating the positions in the content video image with addresses of storage locations storing the corresponding frames of video data. A user input device is provided by which the user selects a particular frame of video data by selecting a position in the content video image, such as by positioning a cursor on the selected position.

The assembly of the content video image can be understood by considering the following example. If a plurality of frames of video data comprise film of a geographic area, each frame can be tagged with a position stamp, indicating the position of the camera when it was taken, and the focal point of the camera. This position stamp can then be translated automatically to a virtual position on a map. The map superimposed with the virtual positions of all the video frames in the plurality then constitutes the content video image. This content video image can be displayed using a bit map graphic system, in which a cursor can be positioned on any position in the content video

image. The position of the cursor is then translated into the position stamp of the frame of video data, and from the position stamp, into an address for the frame.

According to another aspect, the present invention comprises an apparatus or method for generating content addressable video, which is the converse of assembling the content addressable video. In particular, according to this aspect, the content video image is first generated. Positions in the content video image are then translated by a control circuit into camera positioning signals. A controllable camera, such as a robot mounted camera, then generates the frames of video in response to the position control signals derived from the content video image. A processing unit then associates each frame of video data generated by the controllable camera, with positions in the content video image.

The generation of content addressable video according to this aspect of the invention can be understood by considering the following example. Assume that one wanted to generate a content addressable video library of an object, such as the transmission of an automobile. A content video image would then be graphically created in which an icon representing the transmission is placed in a virtual graphic space. A grid, three dimensional, or two dimensional, is then drafted using computer software graphics packages, to create a grid indicating the perspective of the transmission to be filmed. Thus, each

position in the grid would correspond to a frame of video data depicting a different perspective of the transmission.

A cursor is then scanned along the grid, either manually or using automatic computer programs, and cursor position is then translated into a camera control signal. The camera, mounted on a robot, then traverses real space corresponding to the virtual space of the content video image in response to the control signals, while filming the transmission. A processing unit then associates a position tag with each frame of video, and correlates the position tag with a position in the content video image.

According to the invention, a user input device is provided, by which a user selects a particular frame of video by positioning a cursor on the content video image. This allows for highly interactive video systems in which frames of video data are addressed by content in an easily understandable and fun to use manner.

Other aspects and advantages of the invention can be seen upon review of the drawings, the detailed description, and the claims which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of a system for generating, or assembling content addressable video according to the present invention.

Fig. 2 is a schematic diagram of a system for interactively displaying content addressable video according to the present invention.

Fig. 3 is a flow chart illustrating steps in a method for generating content addressable video according to the present invention.

Fig. 4 is a flow chart illustrating the steps in a method for assembling content addressable video according to the present invention.

Fig. 5 is a diagram of the assembly algorithm module for an uncontrolled camera environment.

DETAILED DESCRIPTION

A detailed description of preferred embodiments of the present invention is described with reference to the figures.

In Fig. 1, a system for assembling or generating content addressable video is illustrated. The system includes a computer 100 which provides processing capability used in assembling or generating the video. A computer is coupled to a camera position control robot 101 or other mechanism for controlling the position of a camera. The camera position is controlled to generate a plurality of frames of video information of an object 102 in a

space. Video frames are then stored in video storage 103. A video monitor 104 is provided for displaying the video frames as they are being filmed, or for accessing the video storage 103 to review the film. A content monitor 105 is provided which includes a graphic film content image 106. The film content image includes a depiction 107 of the object to be filmed, and a grid 108 having a plurality of positions. Positions on the grid 108 indicate the content of corresponding video frames in the video storage. Thus, as the camera position control robot 101 moves the camera 109 along a plurality of camera positions indicated by the grid 110, the computer assigns a key to each frame of video. This key is correlated with a position in the graphic film content image 106 along the grid 108.

A user input device 111, such as a mouse or track ball in the preferred system, can be used to position a cursor icon 112 along the grid 108 in the graphic film content image 106. Thus, the position of the cursor icon 112 indicates the content of a frame of video being displayed on the video monitor 104. Therefore, for the object 102 being filmed from camera position as indicated at 109, and as represented by the cursor icon 112 on the content image 106, an image would be displayed in the video monitor 104, which shows the bottom, left side, and front of the object 102, as schematically illustrated in Fig. 1.

The system can be expanded to include a plurality of cameras for filming a specific object, such as an automobile

transmission. Also, the object 102 can be moved instead of the camera to generate the frames of video.

The content image 106 can be generated before filming the object 102, and thereby used to generate camera position control signals to control the generation of video. Similarly, the film can be shot first, and keys associated with each frame of video. The keys can then be analyzed by the computer 100 in order to generate a content image 106. This content image 106 can be generated at the same time that the camera is being used to film the object, or it can be generated on an as needed basis from a huge library of video frames.

Thus, the system of Fig. 1 can be generalized by providing cameras attached to control arms that can move within a confined space. A virtual map or content image of frame content is mapped in a graphic image displayed on a content monitor. Control of the cameras, and their movements and point of view, are functions of positioning of camera icons or cursors in the graphic content image.

Fig. 2 illustrates the preferred system for displaying the content addressable video according to the present invention. In this system, a content monitor 200 is provided which is connected to the computer 201. Two video disk players 202 and 203 store a plurality of video frames. A video switcher 204 which is controlled by computer 201 selects output video from the video disks in the players 202 and 203. The output video supplied to video monitor 205. A cursor control input device

206, like a mouse or track ball in the preferred system, is coupled to the computer 201. A user interactively positions the cursor 207 within the content video image 208 on the content monitor 200. A perspective of the object is displayed on the video monitor 205 which is indicated by the position of the cursor 207 in the content image 208. Thus, for the virtual space content image 208 illustrated in Fig. 2, a frame corresponding to the position of cursor 207, will provide a view of the object illustrated in the content image 208, which shows the bottom side, left side, and front side, as schematically illustrated in Fig. 2.

Background concerning how to implement these interactive display systems can be found in the above cross-referenced U.S Patent No. 4,857,902.

Fig. 3 illustrates the flow chart for the method using the apparatus of Fig. 1, or similar apparatus, to generate content addressable video. According to this method, a user uses a computer software graphics package or other tools to generate a content image based on desired video frames to be generated (block 300).

Next, the computer 100 is used to assign keys to positions in the content image. For the content image illustrated in Fig. 1, these keys would correspond to the X, Y, and Z positions on the grid 108 (block 301).

Next, the keys are used by the computer 100 to generate camera position control signals which control the robot to film the object in response to the keys (block 302). Next, the keys are stored with or otherwise associated with each generated video image (block 303). The video frames are then compiled in a format which facilitates accessing in response to the keys (block 304). The step of compiling involves assigning the video frames to addresses in the video storage, and providing a means for translating the keys to the address of the corresponding video frame. These are standard computer techniques which can be based on look up tables and the like. Also, this compiling step involves identifying the frames of video on intersecting segments of the grid 108 and storing them on video disks, or other storage means, in storage positions which are accessible within a seek time at least as fast as the update rate of the video monitor. In the preferred system, this is at least 15 times per second.

Finally, a user input device is provided for selecting a video frame in response to a position on the content image (block 305). Again, this is provided by positioning a cursor on the content image using an input device. The position of the cursor then identifies a key which can be translated to an address of the corresponding video frame. Using the address, the video frame is accessed and displayed.

Therefore, the content of the video frames is used to access them in a straightforward, highly interactive manner. Furthermore, this content image is used to automatically control

the generation of the video frames to be accessed in this content addressable video scheme.

Fig. 4 is a flow chart illustrating the steps used for assembling content addressable video from a large library of video frames.

This method involves first storing a library of video frames (block 400). Such video frames may, for instance, correspond to film of a highway system.

Next, a key is assigned to video frames or segments of frames that are stored. These keys may correspond to geographic position stamps of the location filmed in the corresponding video frames (block 401). These keys can be calculated using interpolation techniques in which a sequence of video along a given highway, having a known start point and stop point can be assigned keys based on the estimated position of each frame.

The next step involves generating a content image based on the assigned keys (block 402). According to this method, the assigned keys are used to compile a map using bit map graphics or the like, in which each key has a corresponding position on the map. This content image can be generated for a subset of the entire library video frames, which consists of a few video frames or of the entire library.

The next step involves compiling the video frames for addressing in response to the assigned key (block 403). The generated content image is used to compile the video frames by identifying positions on the content image of adjacent keys, and

storing the video frames at addresses indicated by the keys. For a large library of frames, a subset of the library which corresponds to at least a section of the content image is moved into a storage buffer that has reasonable access times, such as a writable optical disc or array of RAM.

Finally, a user input device is provided for selecting a video frame in response to a position on the content image (block 404). Having assembled a subset of the video frames by generating a content image representative of the content of the subset, a user can use a highly powerful interactive scheme for positioning a cursor on the content image to select the particular video frame having the desired content.

The basic tools and methodology for the assembly of content addressable video systems are very similar for the various data acquisition methods. The process involves the marriage between a graphic space, acquired visual data and the relational content image of this visual data in the graphic space. In the system there exist at least an element of organization, i.e., a physical location of visual data and its respective position in a graphic space (content image). This organization is critical to the representation of information and serves as the base methodology for a visual language. Content Addressable Video systems may be built from closed systems, controlled camera environments, and uncontrolled or free camera environments. They may be built from a combination of all three.

A. CLOSED SYSTEM ENVIRONMENT

A closed system implies a graphic or artificial environment. An example of such a system is a CAD workstation which has tools for designing objects as well as for the three dimensional animation of these objects frame by frame into a movie. Software provides the producer the capability to build the content image into the graphic space. The tools for drawing a content image already exist in CAD systems.

Once the content image is constructed, a light is projected from a cursor which represents the focal plane of the camera. A joystick controls the direction of the camera (cursor or camera icon) while the cursor traverses the content image in preview mode. This provides for accurate pan, tilt keys as well as accurate position data. Once the operator decides this content image and camera point of view are correct, he implements an "animate" command and each frame is rendered, stored and finally compiled for interactive control. Hence, a system as described in Fig. 2 with the CAD and animation tools with the content addressable image software technology.

The key stamps consist of position, pan, and tilt with their respective video frame derived directly from their location in the graphic virtual space.

This module provides segments or geometric shapes to be recognized by the camera paths. These shapes may be drawn with the normal draw routines. The program will ask for the frame density along the paths and the camera POV. The line segments

will parse frame locations along the line segments and send keys out to a frame database and then calculate the frame by frame animation. The frames are stored to optical discs or other memory, such as large 3-D arrays of DRAMs or VRAMs, accessed in a massively parallel means, and the content image is assembled. The matrix arrangements are compiled and a cursor appears on the content image in the graphic space once the compilation and assembly is complete providing control to the user.

B. CONTROLLED CAMERA ENVIRONMENT

In this method of data acquisition, the visual data is acquired in controlled filming environments; specifically those where cameras are controlled in stationary or motion controlled environments. The assembly of these content addressable video systems will require predefined matrices of film maps generated on a graphic computer platform which translates actual commands to a camera motion control platform for videomap production and automated assembly. In this environment, the space which the cameras can cover are scaled to the virtual graphic space such that an incremental movement of a cursor on a content image solicits a relative movement of the camera (or video once shot and compiled) in its respective space.

In our system, we will place the subject, say an automobile transmission, on the platform.

The algorithm works as follows:

1. Scale Camera Locations in real space to camera locations in the graphic content image space. Also zero out camera pan, tilt and direction POV. Position subject in content image space.

2. Locate graphic model center at x, y, z in graphic virtual space on motion platform.

3. Build the content image in the graphic space using the graphic software tool commands. Or build sequence in real space using actual cameras. The actual camera moves are recorded, stamped, and converted to the graphic space.

4. Stamp keys on frames (or other recording methods discussed below) by recording camera position, POV, Pan, and Tilt in real time while recording frames.

5. Record filmed frames to optical disc player or to other archive technology.

6. Convert camera position stamp locations to content image scale and location. Store key data locations of camera in the content image space frame by frame. Location data consist of x, y, z location, Pan, Tilt, and focal plane.

7. Store locations of frames in content image space (x, y, z) relationship of each frame to its corresponding content image in a graphic space using keys and the system's processing unit.

8. Sort and determine the visual matrix as well as relationship of each frame to its corresponding content image in a graphic space using keys and the system's processing unit.

9. Compile database in its matrix structure.

10. Generate content image space in virtual space.

11. Choose starting point in matrix.

12. Compile and organize frame data and reference content image space relative to virtual space.

Camera System

The way it works is as follows:

Cameras are attached on control arms and can move anywhere in one virtual space. A content image is drawn in response to the camera movement or by hand in the graphic virtual space (computer screen) such that an incremental move or matrix location in the camera space is equal to the incremental vector in the graphic space. In other words, from picture to picture the video matrix corresponds to its content image in its graphic space.

C. UNCONTROLLED (FREE) CAMERA ENVIRONMENT

The third data acquisition environment deals with data acquired in uncontrolled filming environments. This acquisition requires accurate position information and Pan (P), Tilt (T) as frame stamping as keys for content image assembly. These video

matrices are assembled into accurate survey mapping systems as well as other GIS systems for display and overlay capability.

Fig. 5 is a diagram as to the modules of the code in the assembly algorithm. This system integrates an uncontrolled platform (free) or other film systems for videomap production. There is no limit placed upon the size of matrices. This may require multiple stores of optical discs. In this case, the database structure requires an additional data location stamps for archive purposes.

Aerial or Free Camera Systems

In the case of free filming camera systems, (i.e., cameras in helicopters, balloons, Remote Piloted Vehicles, etc.) a final post processing step must be implemented to compile accurate relationships between the content image space and its relative virtual space. The method of scripting of content addressable video systems provide for a combination of free-form data acquisition and tight grid or matrix data acquisition.

The following additional aspects to this workstation are important for flying or developing videomaps for uncontrolled spaces.

1. Camera speed should be directly controlled to provide an accurate matrix when using a free virtual filming system such as a helicopter, balloon, ground gyrostabilized camera mount such as a steadycam etc. This provides compensation for environmental effects of wind and other factors which affect camera position.

2. Actual location of the camera is determined by updates of camera location, pan, tilt axis on a frame by frame basis. This information is processed back to the navigational controls of the camera platform (including helicopter) in order to provide corrections and adjustments in direction location and POV.

3. The system is designed with a predetermined content image structure prior to recording video or film. This content image structure produces a navigational data set for the camera. This navigational information incorporates supporting flying surfaces such as those used to guide the flying machine.

Design of an Aerial Videomap

The design requires a map system which contains actual spatial elements of the area which is to be mapped. Since the current filming system is by helicopter and much of the data acquisition is implemented by sight flying with some GPS navigation aid. A remote powered vehicle drone is utilized for "close-in" mapping.

Position Stamping

The current method of frame location in video is a standard called SEMPTE Time Code. Its structure is as follows:
Hour, Minutes, Seconds, Frames

In the preferred embodiment, this code is expanded into the following structure:

Hour, Minutes, Seconds, Frames, Earth Reference Fixed GPS Receive Position, x, y, z, position GPS (Time T), Camera Receiver Position x, y, z GPS, Velocity (Time T), Acceleration Time (T), Corrected Compass Camera Mount Facing (Time T), Pan degree (Time T), Tilt (Time T), Rotation (Time T), Frame Number and the content image scale to the graphic space (map).

The sample rate of the data will be controlled by the camera frame rate or speeds which determine frame accurate stamping. As frames are shot, they will be written to the nearest sample. Current GPS data is available on one second intervals but may change given satellite positioning and reception quality. Post processing is currently necessary to average distance between GPS position samples, distance covered and number of frames per second. Thus, location stamping requires post processing in this situation. The satellite locations are scrambled and also have to be post processed.

The on-board filming system is designed to send data to a counter and then to the data accumulator per frame of video or film. If film is used, each reel will have its own position database. The position stamps are included with each individual frame. Currently, production technology provides a standard way

of adding SEMPTE time code to video. Position stamping according to the present invention may follow the same standard methodology.

Methods of Storing Stamps and Prescribed Data Keys Are:

1. Actual time stamping and a comparison algorithm of camera location at time (T) and frame exposure time (T).

2. Writing actual time and position data on sound track of video.

3. Use of computer memory for storing frame exposure time and position simultaneously.

Trimble Navigation provides the Trimble Advanced Navigation Sensor System for GPS. Our system will use this technology or some other GPS system which is designed to triangulate satellite signals for position. A second ground station receiver will also be used to improve accuracy and the data collected and merged with the data received (sample rate) in the aircraft and processed to refine error rates and improve position accuracy to an area of 5 meters cube or better.

Another system is currently being designed which utilizes a mirror system on a drone PRV and a laser. The laser is directed at the PRV and a receiver whose position is accurately surveyed, processes the laser band reflection and samples actual RPV location for real time positioning. This system and position stamp per frame will be similar, however, it will provide very accurate positioning.

A software routine will build a system of frame location in the three dimensional virtual space based upon the following organization.

Content Addressable Video Assembly

The following treatment of the software tools which may be used to develop a prescribed sequence of routes and camera position which when implemented will provide an autopilot control, camera position (pan and tilt) and frame controlled for the data acquisition hence the tools for an assembly language.

The elements of this system are:

1. Accurate maps of prescribed videomap area.

The U.S. Geological Survey (USGS) has accurate mapping maps in vector form of many areas which have been processed by satellite. The design of a videomap begins with this information in a workstation. It is not essential to have this information for the design because the data acquisition position stamping will provide the information necessary to merge this information into these map databases at a later date. However, all productions begin with a script or plan based upon a desired application and the sequences of visual material which best fit the application. Obviously, there are many accurate methods of obtaining pictures of the ground; they include SPOT Satellite, Space Shuttle picture systems and high reconnaissance aircraft. A Moviemap or Videomap of these pictures and their translation into continuous imagery via a continuum of connected images in

25 FPS or 30 FPS or some visual translation from frame to frame in a raster frame merger is another option and used in a closed system.

Videomap Production

As mentioned above, the beginning design requires some element of production scripting and design. The GPS system will also be designed as a pilot aid for navigation. The designer begins by using the Content Addressable Video workstation to design his production, that is, the content image to scale in the prescribed graphic space. A location cursor in the aircraft in conjunction with the GPS hardware and a two dimensional map with the actual routes to scale will provide the pilot an on-board navigation system. This is integrated with the autopilot. Though a good quality structure improves the overhead processing requirements and delta graphic overlay displays it is not essential to get it exact. However, it is important to know precisely the position of what was recorded. Pilots are very capable of flying VFR and instruments accurately with navigational assistance.

D. DATA ACQUISITION AND ASSEMBLY OF A CONTENT ADDRESSABLE VIDEO SYSTEM

The assembly techniques can be used in a variety of contexts. For example, an automatic assembly routine can be used for teaching music. In the music example: One might film someone playing a song on a piano (hands only). The script of the song

may be broken down to sound and visual entities of frames of each depression of the keys. Each chord and the associated frames would be an event. The assembly of two chords together would be an expression of events, the multiple expression of events would result in the script.

So the fundamental logic or algorithms behind the Content Addresssable Video System are driven and organized in this example by this fundamental structure.

This example assumes a database of extensive events and a logical form of transition. It is essential to include a distinction between the actual tools of organization and assembly of data and the creative elements which provide a transition continuity to the data.

A database must have a multiplicity of creative transitional elements. Current post production equipment has so many "hacks" to handle a lack of these transitional elements. A leading film maker established the use of "special transition effects" as transitional elements. Hitchcock was a master of the study of transitional elements.

An interactive movie must contain events. These events must be expressed. The interactive dimension is established through creative transitional elements as illustrated in Fig. 5.

Let's design an interactive piano and then assemble a song using this method.

I. Develop the database for the Script

A. Define the number of events 500-1 through 500-6. These events are all chords in the music spectrum.

B. Create the music for each event and store the sound data chord (E - time).

C. Develop transitions between Events. Film expressions (e.g., 501-1 through 501-3) of all combinations of two events. That is, all of the independent physical hand movements from chord event to chord event.

II. Write the script

A. "This Masquerade" c1973 Teddy Jack

```
  Cm              Cm#7          Cm7                    F9
"Are we really happy with this lonely game we play?. . .
Cm                 Ab7     G7  Cm                        Cm#7
Looking for words to say,.. searching but not finding
     Cm7          F9
understanding anyway."
```

B. List Events - (Underlines indicate location of events.) There are 11 events proposed in this song. They are:

E1 - Cm
E2 - Cm #7
E3 - Cm7
E4 - F9
E5 - Cm
E6 - A b7
E7 - G7
E8 - Cm
E9 - Cm #7
E10 - Cm7
E11 - F9

III. Now implement the automated assembly function.

End result for preview is illustrated in Fig. 6.

First frame of hands in the Cm playing position E1. System prepared to cue first Expression E1-E2 (Cm-Cm#7) transition is the hand movement from Cm to Cm#7. Interactive control with cursor (***).

Sound Data and Relational Data Location

Sound of Cm chord based upon movement of location cursor (***).

Content Addressable Video System Process (Automated Procedure)

Step 1

Search database for E1-E11 Expressions

Database Frame Location (arbitrary for this example)

Expression	Event Frames	Transition Frames	Event Frames
1. Cm to Cm#7	1-60	60-360	360-420
2. Cm#7 to Cm7	1500-1560	1560-1860	1860-1920
3. Cm7 to F9	2100-2160	2160-2460	2460-2520
4. F9 to Cm	3000-3060	3060-3360	3360-3420
5. Cm to A b7	3500-3560	3560-3860	3860-3920
6. A b7 to G7	4000-4060	4060-4360	4360-4420
7. G7 to Cm	5000-5060	5060-5360	5360-5420
8. Cm to Cm#7	6000-6060	6060-6360	6360-6420
9. Cm#7 to Cm7	7000-7060	7060-7360	7360-7420
10. Cm7 to F9	8000-8060	8060-8360	8630-8420

In this example, the:
Event Time (t) is 60 frames or 2 seconds
Transition (t) is 300 frames or 10 seconds
Expression (t) is 360 or 12 seconds.

Determine location of all underlines in x, y screen coordinates of content image. In this case, the words designate the map distance between events. In this example, the differential of the x, y coordinates between events provides the

transition scale for the expressions. Total line length x = 160. Hence, each expression will contain:

	x	y	Dx	Dy(line map)		# Frames
E1	0	160		0		
E2	60	160	60	0	50/160(300)	= 94
E3	80	160	20	0	30/160(300)	= 56
E4	140	160	80	0	80/160(300)	= 150
E5	0	130	30	0	30/160(300)	= 56
E6	60	130	60	0	60/160(300)	= 112
E7	70	130	10	0	10/160(300)	= 150
E8	80	130	10	0	10/160(300)	= 19
E9	160	130	80	0	80/160(300)	= 150
E10	30	100	30	0	30/160(300)	= 56
E11	80	100	50	0	50/160(300)	= 94

Record Database

	Event	Transition-	Skip Frames	Event	Recorded New Frame #
E1-E2	0-60	60-360	3	360-420	0-220
E2-E3	1500-1560	1560-1860	5	1860-1920	221-400
E3-E4	2100-2160	2160-2460	1	2460-2520	401-670
E4-E5	3000-3060	3060-3360	5	3360-3420	671-850
E5-E6	3500-3560	3560-3860	3	3860-3920	851-1070
E6-E7	4000-4060	4060-4360	1	4360-4420	1071-1340
E7-E8	5000-5060	5060-5360	15	5360-5420	1341-1480
E8-E9	6000-6060	6060-6360	1	6360-6420	1481-1750
E9-E10	7000-7060	7060-7360	5	7360-7420	1751-1930
E10-E11	8000-8060	8060-8360	3	8360-8420	1931-2150

Assembled Database

Node Num	Nodes	Node	Num Frame	Num Node	Frame	X,Y	Audio
1	1	2	0			0,160	Cm
2	2	1	220	3	220	60,160	Cm#7
3	2	2	400	4	400	80,160	Cm7
4	2	3	670	5	670	140,160	F9
5	2	4	850	6	850	0,130	Cm
6	2	5	1070	7	1070	60,130	Ab7
7	2	6	1340	8	1340	70,130	G7
8	2	7	1480	9	1480	80,130	Cm
9	2	8	1750	10	1750	160,130	C#7
10	2	9	1930	11	1930	30,100	Cm7
11	1	10	2150			80,130	Fb

E. MATRIX ASSEMBLY ALGORITHMS

1. Beginning, End, or flaw in frame data algorithm

Key stamps of the video data are read and stored into a key database. This is particularly useful and essential for the assembly of the video frame matrix. A number of algorithms may be processed during the read and store function from tape to the key database, including the following two important components:

1. Relational Frame Matrix Algorithm

This process studies each frame and their keys to determine their matrix locations. This process establishes common frames, nodes, and the spatial relationships for the content image and its relational virtual space.

2. Image Recognition Key

During the process of recording from tape to key database an algorithm is used to study the differential in pixel change from frame to frame in real time. A key is stored when the differential is large enough from frame to frame to locate a flaw or edit or cut between sequences. This will aid in reaffirming the relational frame matrix algorithm.

SUMMARY

This technology automates the organization and assembly of video frame data such that the acquisition, assembly, and ultimate integration of images may be represented in a relational graphic space via a content image. These systems' real time

capability are a function of speed memory and memory burst rate and the platform will effect the performance. The display format of these large stores of archived image data, content images files and relational graphic spaces form a powerful interactive visual display language.

The foregoing description of preferred embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in this art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

CLAIMS

1. An apparatus for assembling content addressable video, comprising:

storage means for storing a plurality of frames of video data in storage locations having addresses, each frame defining a video image having a content for display;

means, coupled with the storage means, for associating tags with frames of video data in the plurality, the tags indicating the contents of the video images defined by the associated frames;

processing means, coupled to the means for associating, for assembling a content video image in response to the tags, the content video image including positions for corresponding frames of video data in the plurality; and

means, coupled to the processing means, for associating positions in the content video image with addresses of storage locations storing corresponding frames of video data.

2. The apparatus of claim 1, further including:

means for selecting a position in the content video image;

means, coupled with the means for selecting and the means for associating positions, for accessing the frames of video data in the storage means in response to selected positions.

3. An apparatus for generating content addressable video, comprising:

means for generating a content video image representative of an organization of content addressable video, the content video image having positions within the content video image corresponding to desired content of video images to be displayed;

control means, coupled to the means for generating, for generating control signals indicating a content for a video image in response to positions within the content video image;

controllable means, responsive to the control signals, for generating frames of video data, each frame defining a video image having the content indicated by the control signals; and

processing means, coupled to the controllable means and the control means, for associating frames of video data generated by the controllable means with positions in the content video image.

4. The apparatus of claim 3, wherein the controllable means comprises a robot mounted video camera.

5. The apparatus of claim 3, wherein the processing means comprises:

storage means, coupled to the controllable means, for storing frames of video data generated by the controllable means in storage locations having addresses; and

means coupled to the controllable means and the control means, for associating the address of each frame of video data with a position in the content video image.

6. The apparatus of claim 5, further including:

means for selecting a position in the content video image;

means, coupled with the means for selecting and the means for associating, for accessing the frames of video data in the storage means in response to selected positions.

7. A method for assembling content addressable video, comprising:

storing, in an addressable memory, a plurality of frames of video data in storage locations having addresses, each frame defining a video image having a content for display;

associating tags with frames of video data in the plurality, the tags indicating the contents of the video images defined by the associated frames;

assembling a content video image in response to the tags, the content video image including positions indicating the content of corresponding frames of video data in the plurality; and

associating with data processing means the positions in the content video image with addresses of storage locations storing corresponding frames of video data.

8. The method of claim 7, further including:

selecting, with a user input device, a position in the content video image;

accessing, with data processing means, the frames of video data in the storage means in response to a selected position.

9. The method of claim 7, further including:

storing in a cache memory a subset of the plurality of frames, the subset including frames having content indicated by at least a portion of the content video image.

10. A method for generating content addressable video, comprising:

displaying a content video image representative of an organization of content addressable video, the content video image having positions within the content video image corresponding to desired content of video images to be displayed;

selecting with data processing means positions within the content video image;

generating control signals indicating a content for a video image in response to the selected positions within the content video image;

generating frames of video data in response to the control signals, each frame defining a video image having the content indicated by the control signals; and

15 associating with data processing means the generated frames of video data with positions in the content video image.

11. The method of claim 10, wherein the step of generating frames comprises:

controlling a robot mounted video camera in response to the control signals.

12. The method of claim 10, wherein the step of associating comprises:

storing generated frames of video data in storage locations having addresses; and

5 associating the address of each frame of video data with a position in the content video image.

13. The method of claim 12, further including:

selecting with a user input device a position in the content video image;

accessing the frames of video data in the storage means in 5 response to selected positions.

APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO

ABSTRACT

A system and method for assembling or generating content addressable video based on storing a plurality of frames of video data at addressable storage locations. Each frame of video data is stored with a tag which indicates the contents of the video image defined by the associated frame. For assembly, a processing unit assembles a content video image in response to the tags; the content video image, including positions for corresponding frames of video data. Finally, a means, such as a look up table, is provided for associating the positions in the content video image with addresses of storage location storing the corresponding frames of video data. A user input device is provided by which the user selects a particular frame of video data, by selecting a position in the content video image, such as by positioning a cursor on the selected position.

For generating content addressable video, the content video image is first generated. Positions in the content video image are then translated by a control circuit into camera positioning signals. A controllable camera, such as a robot mounted camera, then generates the frames of video in response to the position control signals derived from the content video image. A processing unit then associates each frame of video data generated by the controllable camera, with positions in the content video image.

ADIN 7914 MAH 1/6

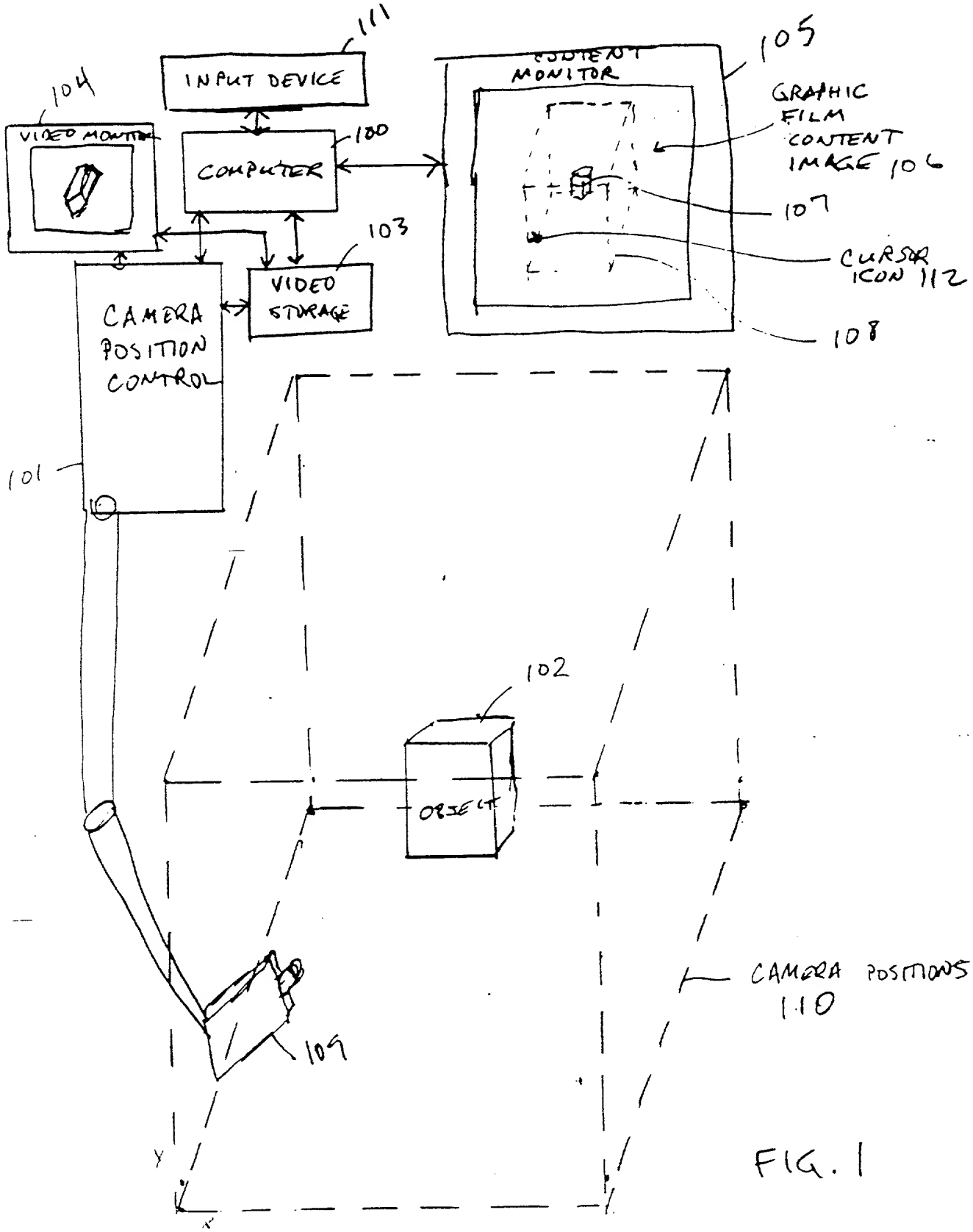


FIG. 1

ADIN 7914 MAA 2/1

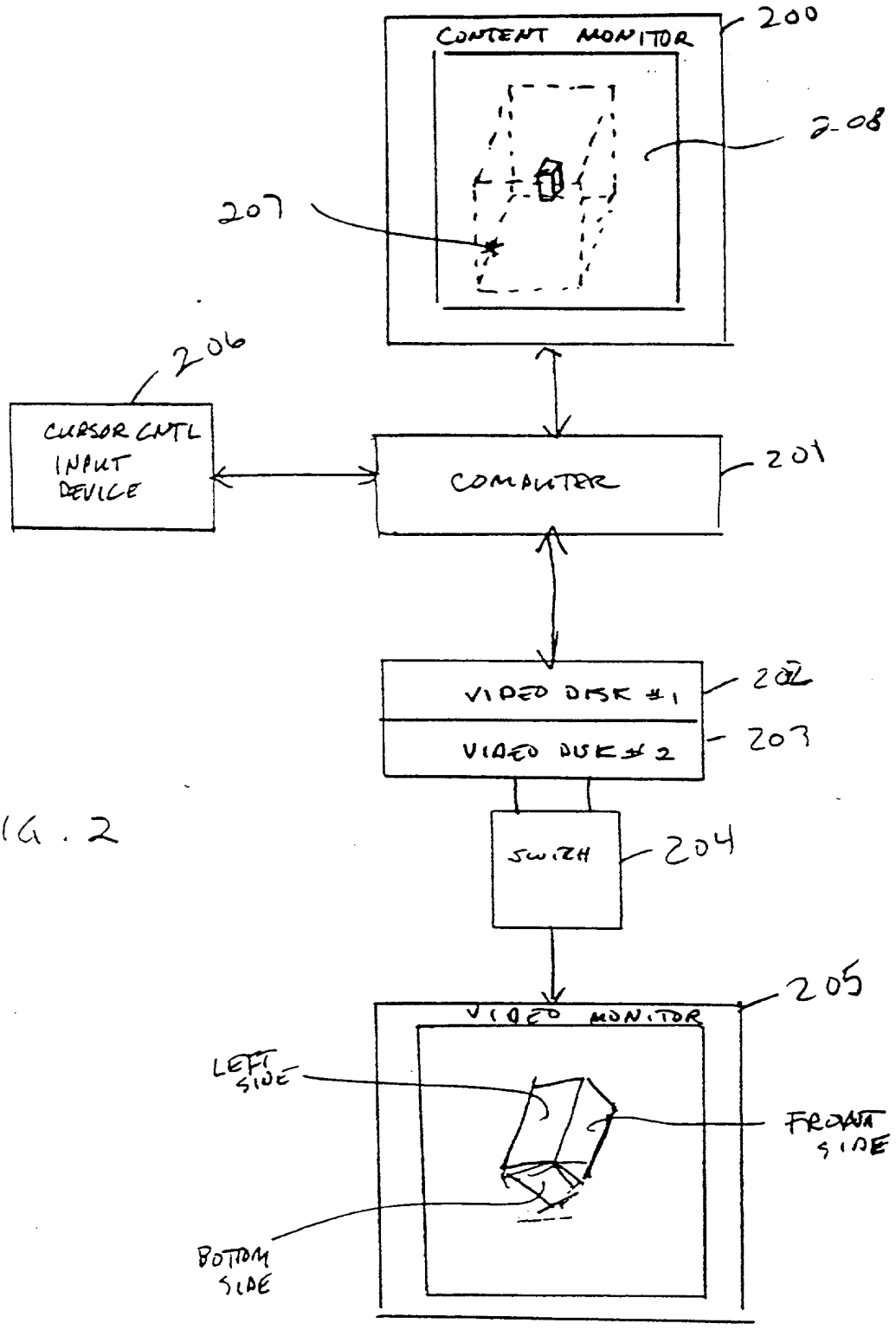


FIG. 2

ADIN7914 MAH 3/3

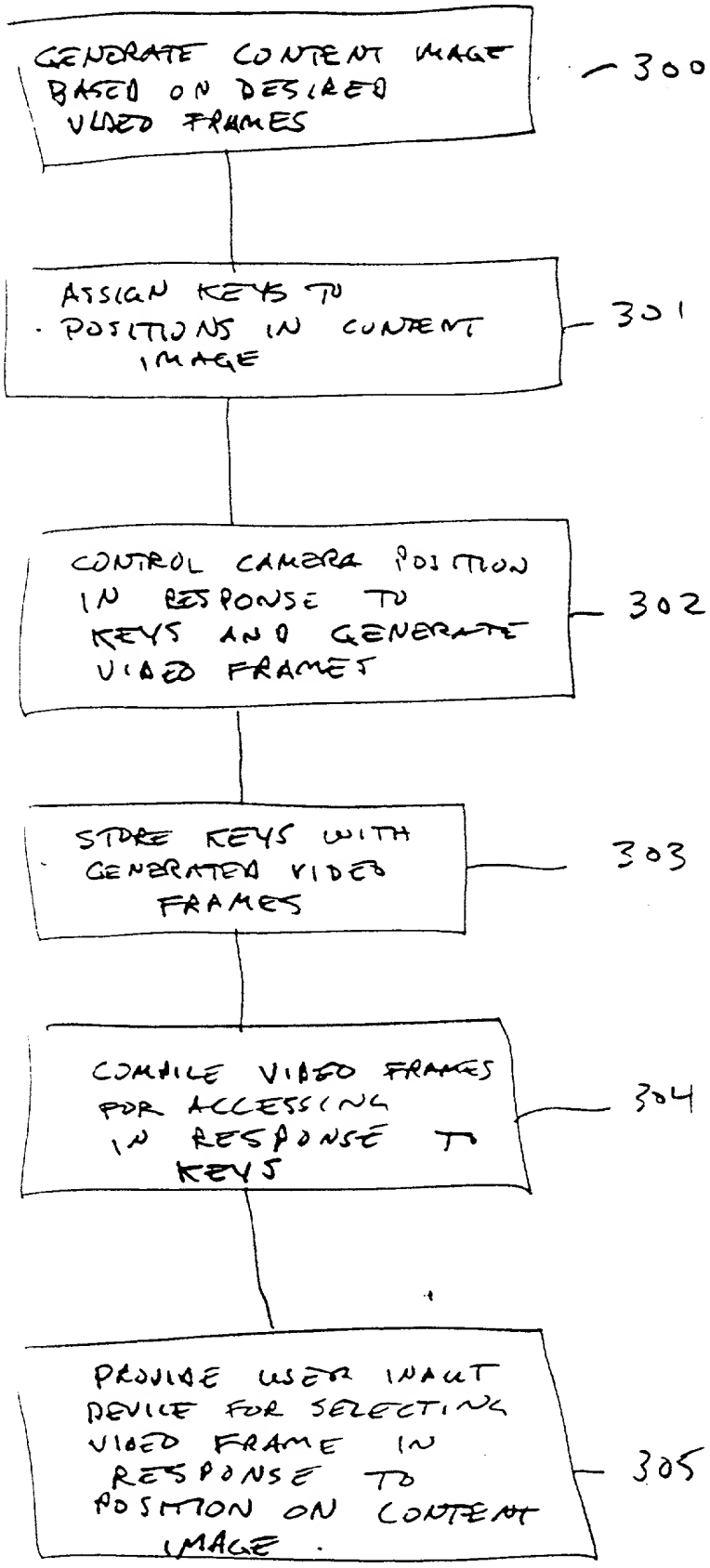


FIG 3

ADIN7914 MAH 1/6

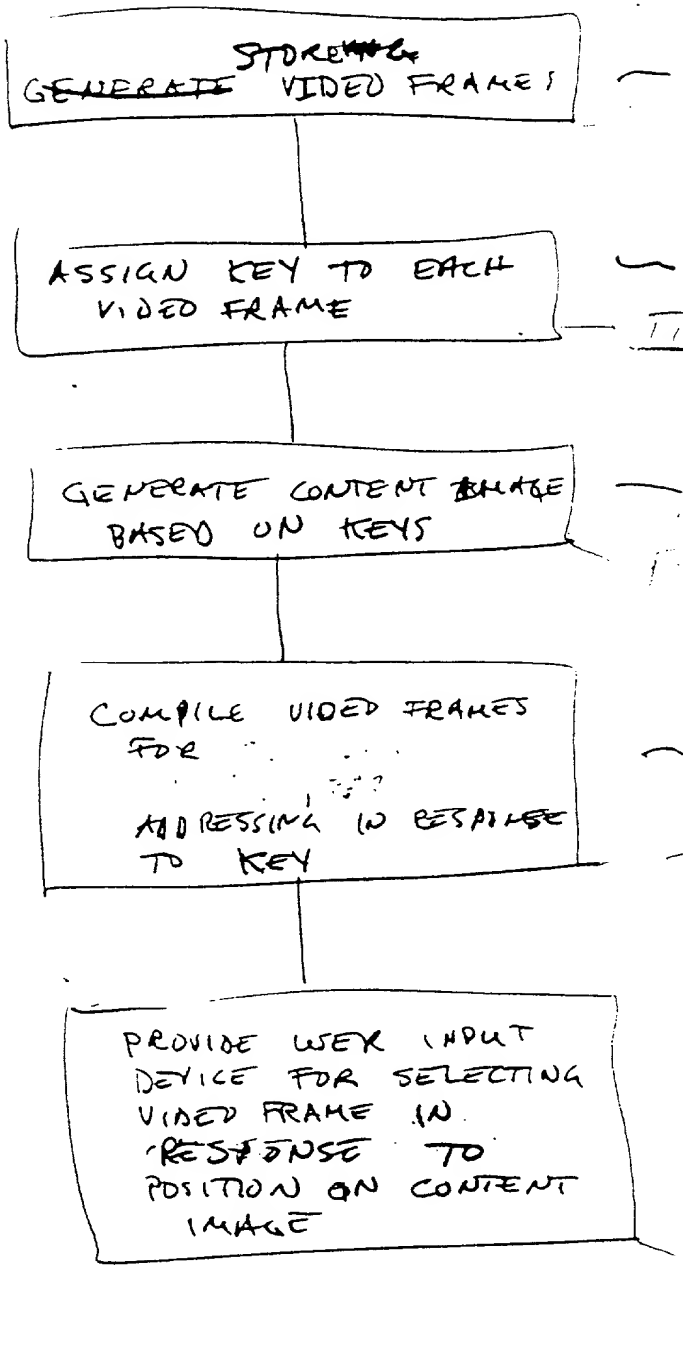
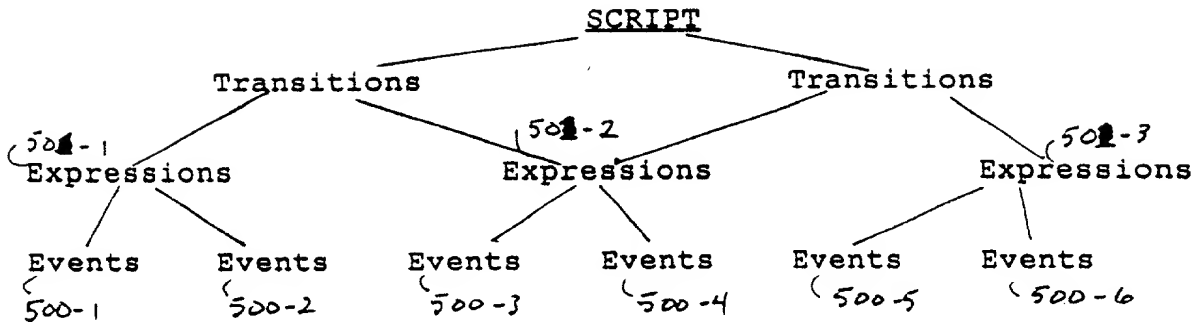


FIG. 4

A-DIN 7914 MAH

FIGURE 5



ADIN 7914 MAH

FIGURE 6

Content Image With Graphic Space

```
Cm---(****)------Cm#7---------Cm7-----------------F9
Are we really happy with this lonely game we play?....

Cm-------------A--b7--G7----Cm-------------------Cm#7
Looking for words to say...searching but not finding

------Cm7-----------F9
understanding anyway..
```

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application	) PATENT APPLICATION
Inventor(s): HILL BRANSCOMB	)
SC/Serial No.: 08/000927	)
Filed: January 6, 1993	)
Title: APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO	)

DECLARATION FOR PATENT APPLICATION
(CONTINUATION-IN-PART)

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if one name is listed below), first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO

the specification of which (check applicable ones):

____ is attached hereto;

__X__ was filed with the above-identified "Filed" date and "SC/Serial No."

__X__ was amended on (or amended through) January 6, 1993.

The present application is a continuation-in-part of Prior Application, Application No. 07/640,489, filed: January 11, 1991 and may be considered to disclose and claim subject matter in addition to that disclosed in the Prior Application, and I hereby claim the benefit of 35 U.S.C. Section 120.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to the examination of the application in accordance with Title 37, Code of Federal Regulations, §1.56, including information which became available between the filing date of the Prior Application and the national or PCT international filing date of the present application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

(1) Full name of sole or first inventor: Hill Branscomb

(1) Residence: 1173 California St. #1612
S.F. Ca 94108

(1) Post Office Address: 220 Montgomery St #3341
S.F. Ca 94104

(1) Citizenship: U.S.A.

(1) Inventor's signature: H. Branscomb

(1) Date: 1/11/93

****

Title 37, Code of Federal Regulations, §1.56

SECTION 1.56. DUTY TO DISCLOSE INFORMATION MATERIAL TO PATENTABILITY

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98.* However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office; or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

* §§1.97(b)-(d) and 1.98 relate to the timing and manner in which information is to be submitted to the Office.

****

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application	) PATENT APPLICATION
Inventor(s): Hill Branscomb	)
Serial No.: 07/640,489	)
Filed: 01/11/91	)
Title: APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO	)

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

APPARATUS AND METHOD FOR ASSEMBLING CONTENT ADDRESSABLE VIDEO

the specification of which (check applicable ones):

XX was filed with the above-identified "Filed" date and "SC/Serial No."

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose information which is material to the examination of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the

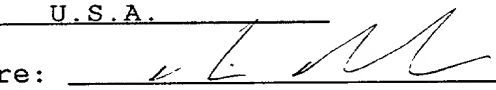
like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

(1) Full name of sole or first inventor: Hill Branscomb

(1) Residence: 2810 Fillmore Street
San Francisco, CA 94123

(1) Post Office Address: same as above

(1) Citizenship: U.S.A.

(1) Inventor's signature: 

(1) Date: 2/12/91

****

****

Title 37, Code of Federal Regulations, §1.56(a)

SECTION 1.56. DUTY OF DISCLOSURE; FRAUD; STRIKING OR REJECTION OF APPLICATION.

(a) A duty of candor and good faith toward the Patent and Trademark Office rests on the inventor, on each attorney or agent who prepares or prosecutes the application and on every other individual who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application. All such individuals have a duty to disclose to the Office information they are aware of which is material to the examination of the application. Such information is material when there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent. The duty is commensurate with the degree of involvement in the preparation or prosecution of the application.